

**CLAIMS**

We claim:

- 1     1.     An apparatus comprising:  
2             an intravascular device to perform a therapeutic treatment; and  
3             at least one optical fiber disposed through the intravascular device, the optical fiber  
4     configured to provide diagnostic information before, during, and after the therapeutic  
5     treatment.
  
- 1     2.     The apparatus of claim 1 wherein the optical fiber is exposed within a vasculature  
2     of a patient at least at one location along the intravascular device.
  
- 1     3.     The apparatus of claim 2 wherein the optical fiber is configured to sense vessel and  
2     blood characteristics.
  
- 1     4.     The apparatus of claim 3 wherein vessel and blood characteristics are selected from  
2     the group consisting of hemodynamic characteristics, hematological parameters related to  
3     blood and blood components and thermal parameters of the vasculature.
  
- 1     5.     The apparatus of claim 1 wherein the intravascular device is a balloon catheter  
2     comprising:  
3             a catheter shaft having an elongated outer member disposed about a tubular inner  
4     member, the tubular inner member having a lumen to receive the optical fiber  
5     therethrough; and  
6             a balloon coupled to a distal portion of the catheter shaft.

1 6. The apparatus of claim 5 wherein the optical fiber is coupled to the tubular inner  
2 member.

1 7. The apparatus of claim 5 wherein the optical fiber is movable within the lumen.

1 8. The apparatus of claim 5 wherein the lumen is to receive an inflation medium  
2 therethrough to inflate the balloon.

1 9. The apparatus of claim 8 wherein a distal tip of the optical fiber is exposed within a  
2 vasculature of a patient at least at one location along the balloon catheter.

1 10. The apparatus of claim 9 wherein the optical fiber is configured to sense vessel and  
2 blood characteristics selected from the group consisting of hemodynamic characteristics,  
3 hematological parameters related to blood and blood components and thermal parameters  
4 of the vasculature.

1 11. The apparatus of claim 5 wherein the tubular inner member has a second lumen  
2 extending at least within a distal portion of the tubular inner member, the second lumen  
3 being substantially parallel to the lumen having the optical fiber therethrough.

1 12. The apparatus of claim 11 wherein the second lumen is a lumen selected from the  
2 group consisting of guidewire lumen, inflation lumen, radiation source lumen, drug  
3 delivery lumen, atherectomy device lumen and laparoscopy lumen.

1 13. The apparatus of claim 12 wherein a distal tip of the optical fiber is exposed within  
2 a vasculature of a patient at least at one location along the balloon catheter.

1 14. The apparatus of claim 13 wherein the optical fiber is configured to sense vessel  
2 and blood characteristics selected from the group consisting of hemodynamic  
3 characteristics, hematological parameters related to blood and blood components and  
4 thermal parameters of the vasculature.

1 15. A catheter comprising:  
2 a catheter shaft having an elongated outer member disposed about an tubular inner  
3 member and an intraluminal gap extending longitudinally between the outer member and  
4 the inner member; and  
5 at least one optical fiber disposed within the intraluminal gap, the catheter capable  
6 of both diagnostic and therapeutic purposes.

1 16. The catheter of claim 15 further comprises an inflatable balloon coupled to the  
2 catheter shaft.

1 17. The catheter of claim 16 further comprises at least one lumen longitudinally  
2 extending through the tubular inner member.

3 18. The catheter of claim 17 wherein the at least one lumen is selected from the group  
4 consisting of guidewire lumen, inflation lumen, radiation source lumen, drug delivery  
5 lumen, atherectomy device lumen and laparoscopy lumen.

1 19. The catheter of claim 15 wherein a distal tip of the optical fiber to contact a  
2 vasculature of a patient at least at one location along the catheter.

1 20. The catheter of claim 19 wherein the at least one optical fiber is configured to sense  
2 vessel and blood characteristics selected from the group consisting of hemodynamic  
3 characteristics, hematological parameters related to blood and blood components and  
4 thermal parameters of the vasculature.

1 21. The catheter of claim 15 wherein a distal portion of the at least one optical fiber  
2 comprises a radiopaque substance.

1 22. A catheter comprising:  
2 a catheter shaft having a tubular inner member coupled to an elongated outer  
3 member, the catheter capable of both diagnostic and therapeutic purposes;  
4 an expandable member coupled to a distal portion of the catheter shaft; and  
5 at least one optical fiber coupled to the expandable member.

1 23. The catheter of claim 22 wherein the expandable member is a balloon.

1 24. The catheter of claim 23 wherein a distal tip of the optical fiber to contact a  
2 vasculature of a patient at least at one location along the balloon.

1 25. The catheter of claim 24 wherein the at least one optical fiber is configured to sense  
2 vessel and blood characteristics selected from the group consisting of hemodynamic  
3 characteristics, hematological parameters related to blood and blood components and  
4 thermal parameters of the vasculature.

1 26. An apparatus comprising:  
2 a catheter comprising a catheter shaft having a lumen therein;  
3 a sheath slidably disposed over the catheter shaft; the catheter shaft and the sheath  
4 defining an intraluminal gap extending longitudinally therebetween; and  
5 at least one optical fiber disposed within the intraluminal gap, the apparatus capable  
6 of both diagnostic and therapeutic purposes.

1 27. The apparatus of claim 26 wherein a distal tip of the optical fiber to contact a  
2 vasculature of a patient at least at one location along the sheath, the optical fiber  
3 configured to sense vessel and blood characteristics selected from the group consisting of  
4 hemodynamic characteristics, hematological parameters related to blood and blood  
5 components and thermal parameters of the vasculature.

1 28. A catheter comprising:

2 a catheter shaft having an inner member coupled to an outer member, the catheter  
3 shaft having a lumen longitudinally therethrough;

4 an elongated member disposed within the lumen; and

5 at least one optical fiber disposed within the elongated member.

1 29. The catheter of claim 28 wherein the elongated member is a coil.

1 30. The catheter of claim 28 wherein the elongated member is a braided member.

1 31. The catheter of claim 28 wherein a distal tip of the optical fiber to contact a  
2 vasculature of a patient at least at one location along the elongated member, the optical  
3 fiber configured to sense vessel and blood characteristics selected from the group  
4 consisting of hemodynamic characteristics, hematological parameters related to blood and  
5 blood components and thermal parameters of the vasculature.

1 32. A system for sensing vessel and blood characteristics, the system comprising:  
2 a data processing system; and  
3 an apparatus coupled to the data processing system, the apparatus comprising an  
4 intravascular device to perform a therapeutic treatment and at least one optical fiber  
5 disposed therethrough, the optical fiber configured to provide diagnostic information  
6 before, during, and after the therapeutic treatment.

1 33. The system of claim 32 wherein a distal tip of the optical fiber to contact a  
2 vasculature of a patient at least at one location along the intravascular device, the optical

3 fiber configured to sense vessel and blood characteristics selected from the group  
4 consisting of hemodynamic characteristics, hematological parameters related to blood and  
5 blood components and thermal parameters of the vasculature.

1 34. A method of sensing vessel and blood characteristics, the method comprising:  
2 inserting an apparatus into a vasculature of a patient, the apparatus comprising a  
3 intravascular device to perform a therapeutic treatment and at least one optical fiber  
4 disposed within the intravascular device, the optical fiber to transmit a light radiation  
5 signal therethrough;  
6 advancing the apparatus to a location in the vasculature;  
7 operating a data processing system coupled to the apparatus to transmit a plurality  
8 of light radiation signals to the location in the vasculature and a plurality of reflected light  
9 radiation signals to a detector in the data processing system; and  
10 processing the plurality of reflected light radiation signals to determine vessel and  
11 blood characteristics.

1 35. The method of claim 34 wherein vessel and blood characteristics are selected from  
2 the group consisting of hemodynamic characteristics, hematological parameters related to  
3 blood and blood components and thermal parameters of the vasculature.

1 36. A method for treating intravascular conditions, the method comprising:  
2 inserting a balloon catheter into a vasculature of a patient, the balloon catheter  
3 comprising an inflatable balloon disposed at the distal end of a catheter shaft and at least  
4 one optical fiber disposed within the balloon catheter, the balloon catheter further

5 comprising an expandable metallic structure disposed at a distal end of the catheter shaft  
6 and substantially over the inflatable balloon;

7 advancing the balloon catheter to a location in the vasculature;

8 operating the balloon catheter and the at least one optical fiber within the  
9 vasculature;

10 operating a data processing system coupled to the balloon catheter to provide vessel  
11 and blood characteristics; and

12 inflating the inflatable balloon to expand the expandable metallic structure within  
13 the vasculature.

1 37. The method of claim 36 wherein operating the data processing system is performed  
2 prior, during or after inflating the inflatable balloon.

3 38. The method of claim 36 wherein the expandable metallic structure is a stent.

1 39. The method of claim 36 wherein vessel and blood characteristics are selected from  
2 the group consisting of hemodynamic characteristics, hematological parameters related to  
3 blood and blood components and thermal parameters of the vasculature.